



DICOM



CONFORMANCE STATEMENT

ADR / *SmartSP07*
Product Lines

Document Number: 81AR800000

CMT MEDICAL TECHNOLOGIES

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1. Introduction

1.1 General information

This document is the DICOM Conformance Statement for Version 3.1 of the SmartSPOT and ADR-1000A (Advanced Digital Radiology) product line of CMT Medical Technologies Ltd. The purpose of this document is to describe how the product collaborates in a DICOM network with other Medical Imaging applications that conform to the DICOM 3.0 standard.

1.2 References

See Digital Imaging and Communications in Medicine (DICOM), parts 1 through 14 (NEMA PS 3.1-14).

1.3 Definitions

See Digital Imaging and Communications in Medicine (DICOM), parts 1 through 14 (NEMA PS 3.1-14).

1.4 Symbols and Abbreviations

- ASCII American Standard Code for Information Interchange
- ADR Advanced Digital Radiology
- AE Application Entity
- ANSI American National Standards Institute
- DICOM Digital Imaging and Communications in Medicine
- DIMSE DICOM Message Service Element
- DIMSE-C DICOM Message Service Element - Composite
- DIMSE-N DICOM Message Service Element - Normalized
- HIS Hospital Information System
- HL7 Health Level 7
- IE Information Entity
- IOD Information Object Definition
- ISO International Standards Organization
- MPPS Modality Performed Procedure Step
- MWM Modality Worklist Management
- NEMA National Electrical Manufacturers Association
- OSI Open Systems Interconnection
- PDU Protocol Data Unit

- RIS Radiology Information System
- SCP Service Class Provider
- SCU Service Class User
- SOP Service-Object Pair
- TCP/IP Transmission Control Protocol/Internet Protocol
- UID Unique Identifier
- FSC File Set Creator

The name **CMT** used in this document refers to CMT Medical Technologies Ltd.

The name **ADR** used in this document refers to the following system models, operating with software version 3.1 (where applicable):

- ADR-1000A/V1
- ADR-1000A/VE
- ADR-1000A/R1
- ADR-1000A/RF
- ADR-1000A/R2
- ADR-1000A/E2
- EPS-Plus
- AWS-1000A/E4
- AngioLink-Plus
- SmartSPOT/RF
- SmartSPOT/DSA

1.5 Important considerations for the reader

The DICOM Conformance Statement by itself is not sufficient to guarantee successful connectivity between the ADR and equipment from other vendors. The following considerations should be made:

- The integration of equipment from different vendors (including CMT) goes beyond the scope of the DICOM 3.0 standard and the DICOM Conformance Statement from CMT and other vendors. It is the responsibility of the user (or the user's agent) to assess the application requirements and to design a solution that integrates CMT equipment with equipment from other vendors.
- When the comparison of this DICOM Conformance Statement with a similar document produced by another vendor indicates that connectivity should be possible, it is the responsibility of the user (or user's agent) to verify this by carrying out the necessary validation tests and to check whether all the required functionality is met.
- CMT reserves the right to make changes in the ADR architecture in order to assure compliance with future DICOM requirements. The user (or user's agent) should ensure that any equipment connected via DICOM to CMT's equipment also follows the future evolution of the DICOM 3.0 standard. Failure to do so may result in partial loss of connectivity.

2. Implementation Model

The ADR users can store images and other data directly on the system's hard disk. Images can be **exported** to a DICOM archive server or workstation on a network or **printed** using a DICOM-compliant printer.

The user is capable of querying a DICOM **Worklist** Server for a list of scheduled patients procedures. Information regarding the procedure(s) performed can be transferred to a **Modality Performed Procedure Step** (MPPS) Server.

The ADR can store images using the General Purpose CD-R Image Interchange Profile Class.

2.1 Application Data Flow Diagram

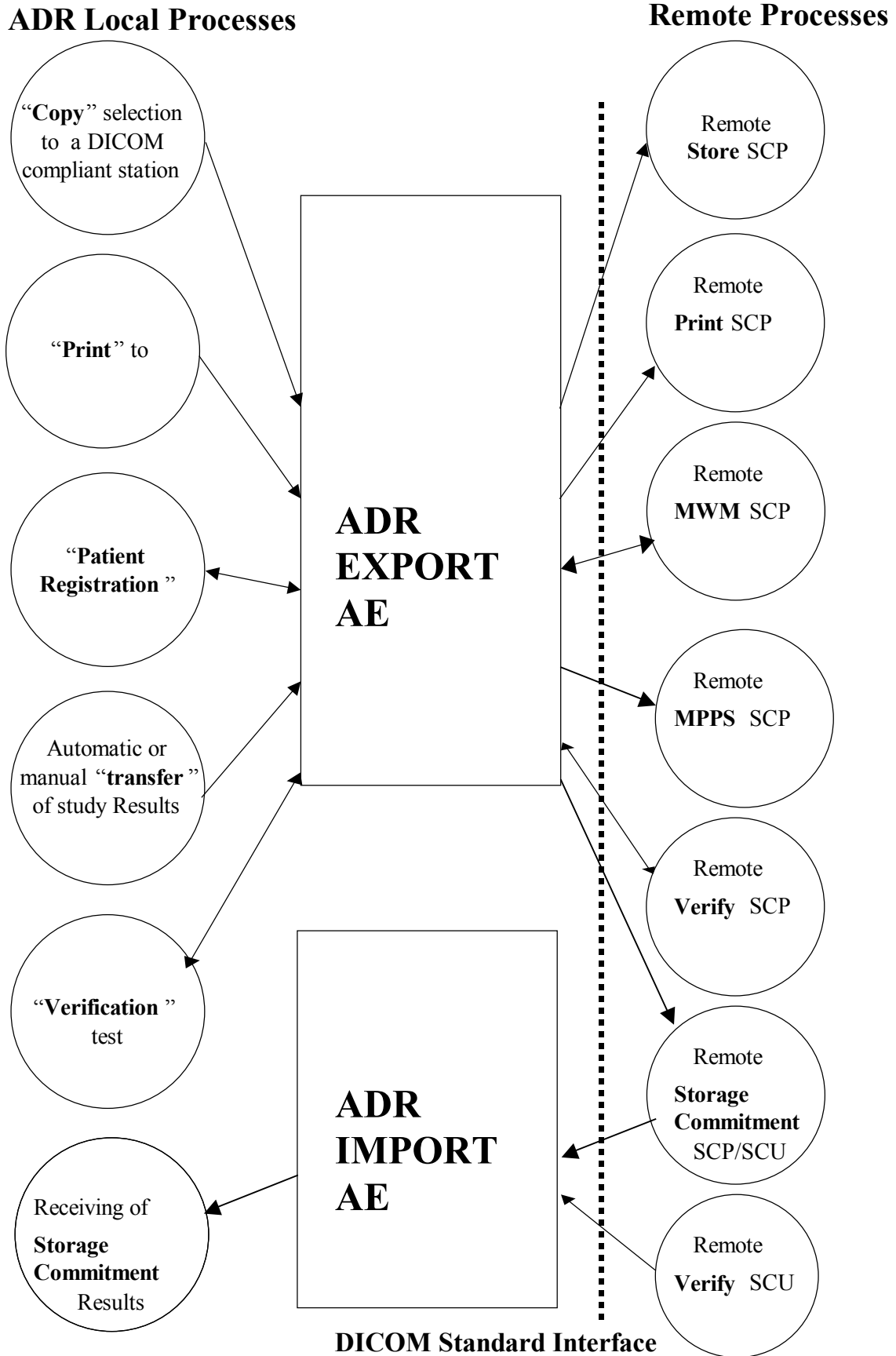




Figure 1: Implementation Model

2.2 Functional description of Application Entities

2.2.1 Verify (SCU) Real-World Activity

The ADR AE is used to verify that a remote DICOM device is active on the network. It therefore performs the following tasks:

- Establishes a DICOM association with a remote DICOM device.
- Performs verification of the presence of a remote DICOM device in the network.
- Closes the association after the verification process is completed.

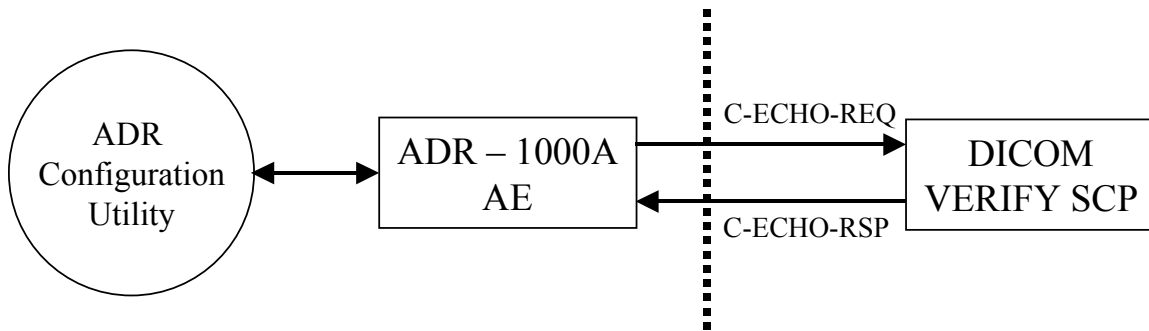


Figure 2: Verification Model

2.2.2 Store (SCU) Real-World Activities

The ADR AE application entity performs all the functions to transmit images and associated data to network servers and/or workstations. It therefore performs the following tasks:

- Builds DICOM RF, XA or SC Information Objects
- Establishes a DICOM association with a remote DICOM device
- Performs storage of DICOM RF/XA/SC Information Object to a DICOM device
- Closes the association after each Information Object is transferred

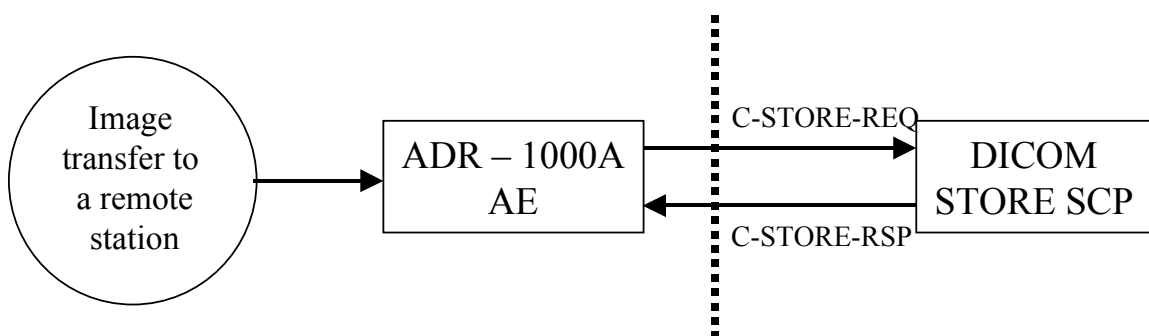


Figure 3: Store Model

2.2.3 Print (SCU) Real-World Activities

The ADR AE provides all aspects of the Print Management SCU. The ADR AE performs the following tasks:

- Builds DICOM Basic Grayscale Print Objects

- Establishes an association with a remote DICOM device
- Performs transmit DICOM Basic Grayscale Print Objects to a remote DICOM device
- Closes the association after Information Objects are transferred.

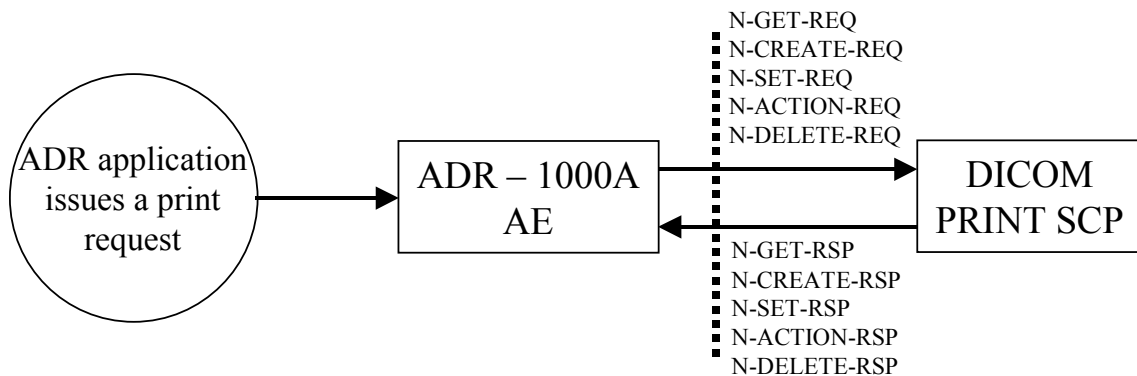


Figure 4: Print Model

2.2.4 Worklist (SCU) Real-World Activity

The ADR AE supports the DICOM Basic Worklist Management as a SCU. The AE initiates an association to the active Worklist server when a Worklist query is selected via the Patient Registration screen. The ADR AE performs the following tasks:

- Establishes a DICOM association with a remote DICOM device.
- Performs request of DICOM Modality Worklist Objects to a remote DICOM device.
- Retrieves patient list with Scheduled Procedure Step information from a remote DICOM device.
- Closes the association once a matching list is received from the Worklist server.

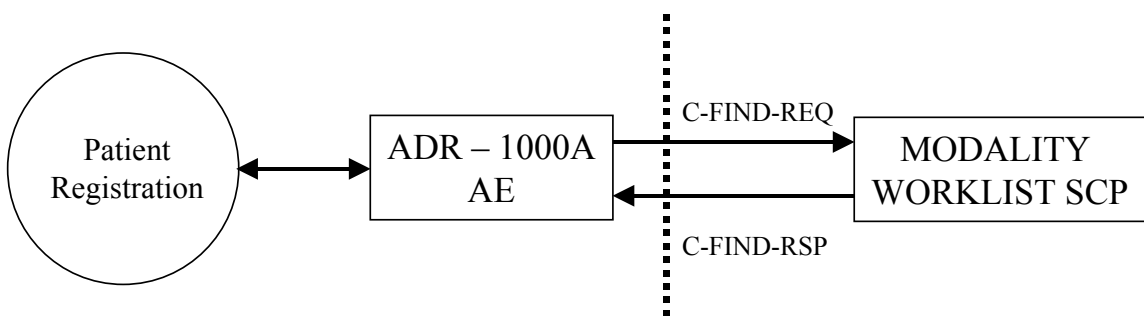


Figure 5: Modality Worklist Model

2.2.5 Modality Performed Procedure Step (SCU) Real-World Activity

The ADR AE supports the Modality Performed Procedure Step (MPPS) in the role of SCU. The ADR AE performs the following tasks:

- Builds DICOM Modality Performed Procedure Step Objects.
- Establishes DICOM Association with a remote DICOM device.
- Performs transmit of DICOM Modality Performed Procedure Step Objects to a remote DICOM device.

- Closes the association once the relevant study details are transferred to the remote DICOM device.

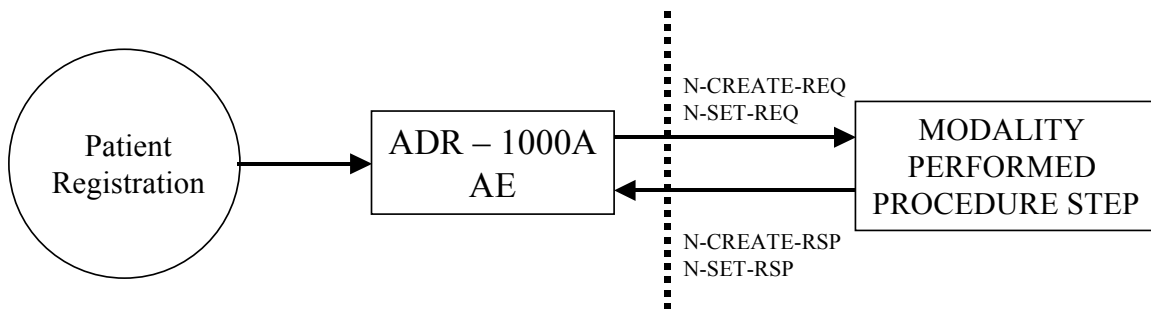
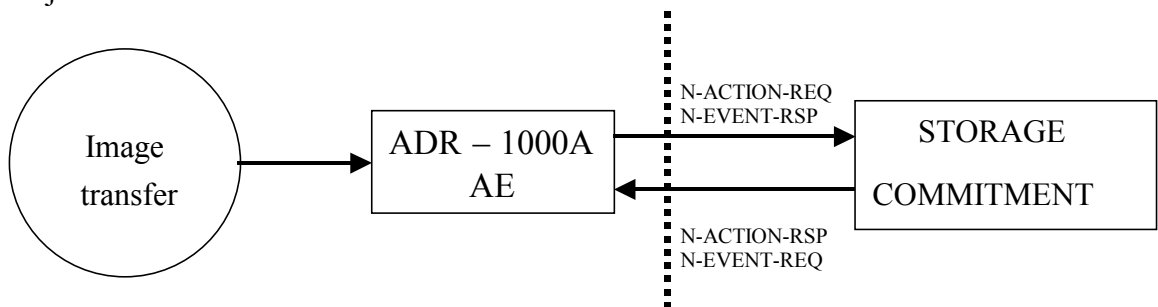


Figure 6: MPPS Model

2.2.6 Storage Commitment (SCU) Real-World Activity

The ADR AE supports the Storage Commitment push model in the role of SCU and SCP. The ADR AE performs the following tasks:

- Builds DICOM Storage Commitment push model Objects.
- Establishes DICOM Association with a remote DICOM device.
- Performs transmit of DICOM Storage Commitment push model Objects to a remote DICOM device.
- Closes the association once the relevant study details are transferred to the remote DICOM device.
- Waits for association request from remote DICOM storage commitment device.
- Accepts association requests and receives DICOM Storage Commitment push model Objects from the remote DICOM device.



2.2.7 Media Storage (FCU) Real-World Activity

The ADR AE can create File Set on CD-R media and write SOP instances upon.

2.3 Sequencing of Real-World Activities

2.3.1 Features

2.3.1.1 *Manual verification (available in Service Mode only)*

- Upon pressing the TEST button in the DICOM configuration utility, the ADR verifies the existence of a remote DICOM device in the network.
- IP address and port number must be specified.

2.3.1.2 *Automatic or manual transfer of images, series, study or patient unit*

- Acquired images are automatically sent upon registration of a new patient.
- Images may be transferred as **full-resolution** images or in **sub-divided** format, according to the selected acquisition mode.
- The operator requests to send specific images after selecting them from any of the ADR's applications.
- In case the image transfer fails, the operator can manually attempt to resend the image at a later stage.
- The requests are placed on a queue and executed in the background.

2.3.1.3 *Automatic or manual transfer of images to a DICOM-compliant imager*

- Acquired images are automatically sent upon registration of a new patient.
- The film layout can be specified as desired, up to a maximum of 20 frames per film.
- The operator requests to print specific images after selecting them from any of the ADR's applications.
- In case an error occurs during the printing process, the operator can manually attempt to resend the film at a later stage.
- The requests are placed on a queue and executed in the background.

2.3.1.4 *Manual and Automatic request of patients list*

- The operator requests the patient information from the Modality Worklist Management server according to user-defined search criteria.
- The operator retrieves the patient information list with Scheduled Procedure Step information.
- The following data fields will be populated on the patient screen if available from the Modality Worklist server:

•

Table I: MWM attributes used during the Patient Registration process

Attribute Name	Tag
Patients Full Name	(0010,0010)
Patient ID	(0010,0020)
Accession Number	(0008,0050)
Date of Birth	(0010,0030)
Patient Sex	(0010,0040)
Referring Physician	(0008,0090)
Remarks (Patient Comments)	(0010,4000)
Requesting Physician	(0032,1032) or (0008,0090)*
Scheduled Procedure	(0040,0007) or (0032,1060)*

(*) Configurable via an ADR internal software key.

- If more than 75 matching records are found in the query, the user will be prompted to limit the search by entering additional search criteria.

2.3.1.5 Automatic or manual transfer of study results

- The study results are **automatically** transferred upon registration of a new patient.
- The user is **prompted** to define the last examined patient **status** (i.e. discontinued/in progress/completed) upon logging off the system.
- In case a patient is examined in split sessions, the relevant study results are transferred upon completion of the **full** examination.
- The ADR will attempt to send all **pending** commands to the MPPS server upon logging on the system.
- The commands are placed on a **queue** and executed in the **background**.

2.3.1.6 Automatic or manual requests for safe keeping images

- After image transfer is complete (for a predefined STORE SCP) a request for safe keeping images is issued.
- The requests might be issued for each transferred image solely or for a group of images.
- ADR waits for results from the remote server concerning his ability to apply the above requests.

2.3.1.7 Manual request of Burning images on CD-R

- The operator asks for saving images on the CD-R media.

2.3.2 Operation

2.3.2.1 Manual verification

- In DICOM Configuration utility, select the desired DICOM device.
- Press the TEST button..

- In case of Success an OK message will appear.
- In case of failure, a failure message will appear.

2.3.2.2 Automatic or manual transfer of images, series, study or patient unit

The operation for **manual** image transfer is as follows:

1. **Select** the images/series/studies/patients to be transferred to the network server or workstation.
2. Select the **destination** of the selection.
3. **Request** the transfer.

In case the **automatic** transfer capability is invoked, **all** the images acquired for the **current** patient are transferred to the network server/workstation upon **registration** of a new patient.

2.3.2.3 Automatic or manual transfer of images to a DICOM-compliant imager

The operation for **manual** printing of images is as follows:

1. **Select** the images/series/studies/patients to be transferred to the DICOM-compliant printer.
2. Select the **destination** of the selection.
3. **Request** the printing.

In case the **automatic** transfer capability is invoked, **all** the images acquired for the **current** patient are transferred to the DICOM-compliant printer upon **registration** of a new patient.

2.3.2.4 Manual request of patients list

The operation for **querying** a Worklist from the server is as follows:

1. **Select** the criteria patients should be sorted according to.
2. Press the **Query IS** button in the patient registration screen.
3. **Confirm** the request.
4. **Register** a **new** patient or **add** a group of patients to a **list** prepared in advance.

2.3.2.5 Automatic or manual transfer of study results

The operation for the **automatic** transfer of a study results is as follows:

1. Send the study results (of current patient) upon registration of a new patient.

In case the automatic transfer fails, the operator may **manually** send the results at a later stage.

2.3.2.6 Automatic or manual requests for safe keeping images

The operation for request of safe keeping images is as follows:

Initially the request is sent after successful transfer of an image to the STORE SCP which is selected for safe keeping of images.

Further requests are issued (manually by the user or automatically) in case the remote server doesn't reply (on a different association that it has to initiate) or the remote server indicates a failure in a safe keeping of an image (which resends the failed image again in a manual or automatic manner).

2.3.2.7 Manual request of Burning images on CD-R

The operation for request burning images is as follows:

The operator chooses the images for burning and presses the dedicated button or menu option for burning images on CD-R.

3. AE Specifications

The following specifications apply to the AE as described in Figure 1.

3.1 ADR AE specification

The ADR AE provides conformance to the following DICOM Services SOP Classes as an SCU:

Table II: Supported SOP Classes

Service SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1
RF Image Information Object	1.2.840.10008.5.1.4.1.1.12.2
XA Image Information Object	1.2.840.10008.5.1.4.1.1.12.1
Secondary Capture Image Information Object	1.2.840.10008.5.1.4.1.1.7
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2
Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4
Printer SOP Class	1.2.840.10008.5.1.1.16
Modality Worklist Information Model -FIND SOP Class	1.2.840.10008.5.1.4.3.1
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1
Media Storage Directory Storage	1.2.840.10008.1.3.10

3.1.1 Association Establishment Policies

3.1.1.1 General

The ADR AE will utilize and understand the following Application Context Name:

Table III: Application Context Name

DICOM V3.0 Application Context	1.2.840.10008.3.1.1.1.1
--------------------------------	-------------------------

The maximum PDU size of the ADR AE is 16Kbyte.

3.1.1.2 Number of Associations

The ADR AE can only establish one association at a time, independent of the number of destinations chosen.

3.1.1.3 Asynchronous Nature

The ADR AE allows a single outstanding operation on any association. Therefore, the ADR AE does not support asynchronous window negotiations.

3.1.1.4 Implementation Identifying Information

- Implementation class UID 2.16.840.1.113669.632.3.1.1.2.7
- Implementation Version Name: ADR-3.1

3.1.1.5 Configurable Parameters

- Time Out.
- Most of the IOD attributes.
- Local and Remote AE titles.

3.1.1.6 Support of Extended Character Sets

The ADR supports the following character sets:

- ISO-IR 6
- ISO-IR 100
- ISO-IR 87
- ISO-IR 13

3.1.2 Association Initiation by Real-World Activities

The ADR AE initiates an association when the operator chooses any of the following activities:

- Automatic or Manual transfer of images, series, study or patient unit
Storage. Create and store a RF, XA or SC image to a remote DICOM device.
- Automatic or Manual print request
Print. Request print images to a remote DICOM device.
- Manual request of patient list
MWM. Request query and retrieve patient list.
- Automatic or manual transfer of study results
MPPS. Create and send MPPS to a remote DICOM device.
- Automatic or manual requests for safe keeping images
Storage Commitment. Send Storage commitment requests to a remote DICOM device.

3.1.3 Real-World Activity – Verification (SCU)

The ADR systems supports Verification service Class as SCU. Verification is invoked in the DICOM configuration utility specifically for each DICOM service.

3.1.3.1 Proposed Presentation Contents – Verification

The ADR AE proposes the following Presentation Contents shown below:

Table IV: Verification Presentation Context Table

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Verification	1.2.840.10008.1.1	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

3.1.4 Real-World Activity – Store (SCU)

Images can be transferred to one or more DICOM Store SCP, the ADR establishes an association with one identified DICOM device (i.e. one of the Network Archive Servers, Workstation Servers) at a time.

The ADR can be configured to automatically send the images at the end of the examination, or manually transfer selected images.

3.1.4.1 Associated Real-World Activities

An association is established when the user initiates a “Copy to” operation from any of the ADR applications.

Individual images or entire examinations can be transferred to the selected DICOM Store device. The association is opened and closed for each image transfer. In case the transfer fails, images are queued and operator’s intervention is required in order to resume data transfer.

3.1.4.2 Proposed Presentation Context

The ADR AE proposes the following Presentation Contents shown in the following table:

Table V: Store Presentation Context Table

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Little Endian	1.2.840. 10008.1.2.1	SCU	None
XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Implicit VR Little Endian	1.2.840. 10008.1.2	SCU	None
XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Big Endian	1.2.840. 10008.1.2.2	SCU	None
RF Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Explicit VR Little Endian	1.2.840. 10008.1.2.1	SCU	None
RF Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Implicit VR Little Endian	1.2.840. 10008.1.2	SCU	None
RF Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Explicit VR Big Endian	1.2.840. 10008.1.2.2	SCU	None
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840. 10008.1.2.1	SCU	None
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840. 10008.1.2	SCU	None
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Big Endian	1.2.840. .10008.1.2.2	SCU	None

The ADR system always acts as a SCU and is the client in a client-server model. The Store REAL WORLD ACTIVITY provides standard extended conformance as an SCU for the following standard Storage Service Class SOP:

Table VI: Supported SOP Classes

Service SOP Class Name	SOP Class UID
XA Image Information Object	1.2.840.10008.5.1.4.1.1.12.1
RF Image Information Object	1.2.840.10008.5.1.4.1.1.12.2
Secondary Capture Image Information Object	1.2.840.10008.5.1.4.1.1.7

3.1.4.3 Specific Conformance – Store

The ADR AE operation involves the following sequence of steps for each image transfer:

1. Association establishment (requestor only).
2. Data transfer (SCU only).
3. Association release (requestor only).

The ADR AE judges that the transfer of an image was successful when the result of step (2) above is “success”, even if the result of step (3) is “failure”.

3.1.4.4 AE Title/Presentation Address Mapping

This mapping is defined during the ADR installation procedure.

Both the local and remote names can be arbitrary defined. Local AE Titles for the different services should be different.

3.1.4.5 XA Information Object Definition

The following table denotes the attributes included in the XA Image Object as implemented on the ADR system. Attributes **not** listed are **not** used.

Table VII: XA IOD Attributes

Attribute Name	Tag	Notes
Patient Module		
Patient Name	(0010,0010)	From Patient Registration screen. Value is set to NULL if no patient name is specified.
Patient ID	(0010,0020)	From Patient Registration screen. This field should always be specified.
Patient Birth Date	(0010,0030)	From Patient Registration screen. Value is set to NULL if no birth date is specified.
Patient Sex	(0010,0040)	From Patient Registration screen. Value is set to NULL if no patient sex is specified.
Referenced Patient Sequence	(0008,1120)	This information is present only if retrieved from the MWM server.
>Referenced SOP Class UID	(0008,1150)	
>Referenced Instance UID	(0008,1155)	
Patient Comments	(0010,4000)	As received from the MWM server.
General Study Module		
Study Instance UID	(0020,000D)	From MWM server or internally generated.
Study Date	(0008,0020)	Date the study number is generated.
Study Time	(0008,0030)	Time the study number is generated..
Referring Physician's Name	(0008,0090)	From Patient Registration screen. May be edited by the user.
Study ID	(0020,0010)	Internally generated by the ADR.
Accession Number	(0008,0050)	From MWM server or internally generated. This information is present only if the MWM service is

		enabled.
Referenced Study Sequence	(0008,1110)	Sent if the tag is received from the MWM server.
>Referenced SOP Class UID	(0008,1150)	
>Referenced SOP Instance UID	(0008,1155)	
General Series Module		
Modality	(0008,0060)	XA
Series Instance UID	(0020,000E)	Internally generated by the ADR.
Series Number	(0020,0011)	Internally generated by the ADR.
Series Date	(0008,0021)	Date the series number is generated.
Series Time	(0008,0031)	Time the series number is generated..
Performing Physician's Name	(0008,1050)	From Patient Registration screen. May be edited by the user.
Protocol Name	(0018,1030)	ADR internal study name. Selected by the user.
Series Description	(0008,103E)	Series label. May be edited by the user.
Body Part Examined	(0018,0015)	From Patient Registration screen. May be edited by the user. Value is set to NULL if no body part is specified.
Requested Attributes Sequence	(0040,0275)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
> Requested Attributes ID	(0040,1001)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>Scheduled Procedure Step ID	(0040,0009)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>Scheduled Procedure Step Description	(0040,0007)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>Scheduled Action Item Code Sequence	(0040,0008)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>>Code Value	(0008,0100)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>>Coding Scheme Designator	(0008,0102)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>>Coding Scheme Version	(0008,0103)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.

>>Coding Meaning	(0008,0104)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
Performed Procedure Step ID	(0040,0253)	ADR internal study name. Selected by the user.
Performed Procedure Step Start Date	(0040,0244)	
Performed Procedure Step Start Time	(0040,0245)	
Performed Procedure Step Description	(0040,0254)	From Patient Registration screen. May be edited by the user.
Performed Action Item Code Sequence	(0040,0260)	Always NULL.

General Equipment Module

Manufacturer	(0008,0070)	
Institution Name	(0008,0080)	Hospital Name (for each image)
Station Name	(0008,1010)	From Configuration Utility (name + location).
Manufacturer's Model Name	(0008,1090)	Name displayed on the system's welcome screen.
Device Serial Number	(0018,1000)	Sent for ADR-1000A/R1 and ADR-1000A/R2 systems.

General Image Module

Instance Number	(0020,0013)	Internally generated from ADR.
Patient Orientation	(0020,0020)	Always NULL.
Content Date	(0008,0023)	
Content Time	(0008,0033)	
Image Type	(0008,0008)	ORIGINAL/DERIVED. PRIMARY/SECONDARY. SINGLE PLANE.
Derivation Description	(0008,2111)	Sent only if (0008,0008) is DERIVED.
Image Comments	(0020,4000)	
Burned in Annotation	(0028,0301)	YES or NOT, depending on whether the relevant option was selected via the ADR's DICOM setup menu.
Lossy Image Compression	(0028,2110)	Set to 00.

Image Pixel Module

Samples Per Pixels	(0028,0002)	Set to 1.
Photometric Interpretation	(0028,0004)	Set to Monochrome 2.
Rows	(0028,0010)	Set to 1024, 2048 or 4096.
Columns	(0028,0011)	Set to 1024 or 1280.

Bits Allocated	(0028,0100)	Set to 8 Bit for Fluoroscopy or 16 Bit for Photospot.
Bits Stored	(0028,0101)	Set to 8 or 10.
High Bit	(0028,0102)	Set to 7 or 9.
Pixel Representation	(0028,0103)	Set to 0000H.
Pixel Data	(7FE0,0010)	
X-Ray Image Module		
Lossy Image Compression	(0028,2110)	Set to 00.
Image Type	(0008,0008)	ORIGINAL/DERIVED. PRIMARY/SECONDARY. SINGLE PLANE.
Pixel Intensity Relationship	(0028,1040)	DISP/LIN.
Samples Per Pixel	(0028,0002)	Set to 1.
Photometric Interpretation	(0028,0004)	Set to Monochrome 2.
Bits Allocated	(0028,0100)	Set to 8 Bit for Fluoroscopy or 16 Bit for Photospot.
Bits Stored	(0028,0101)	Set to 8 or 10.
High Bit	(0028,0102)	Set to 7 or 9.
Pixel Representation	(0028,0103)	Set to 0000H.
Derivation Description	(0008,2111)	Sent only if (0008,0008) is DERIVED.
X-Ray Acquisition Module		
KVP	(0018,0060)	Sent with value available from X-ray generator via RS-232 interface. Value will be NULL if no communication is available.
Radiation Setting	(0018,1155)	GR for photospot images. SC for fluoroscopy images.
X Ray Tube Current	(0018,1151)	Sent with value available from X-ray generator via RS-232 interface. Value will be NULL if no communication is available.
Exposure Time	(0018,1150)	Sent with value available from X-ray generator via RS-232 interface. Value will be NULL if no communication is available.
Intensifier Size	(0018,1162)	Diameter of X-ray intensifier in mm.
Field of View shape	(0018,1147)	Set to ROUND.

Display Shutter Module ⁽¹⁾		
Shutter Shape	(0018,1600)	Always RECTANGULAR
Left Vertical Edge	(0018,1602)	
Right Vertical Edge	(0018,1604)	
Upper Horizontal Edge	(0018,1606)	
Lower Horizontal Edge	(0018,1608)	
Presentation Value	(0018,1622)	Always 0000H
Collimator Module ⁽²⁾		
Collimator Shape	(0018,1700)	Always RECTANGULAR
Left Vertical Edge	(0018,1702)	
Right Vertical Edge	(0018,1704)	
Upper Horizontal Edge	(0018,1706)	
XA Positioner Module		
Distance Source to Detector	(0018,1110)	Sent with value available from X-ray generator via RS-232 interface. Value will be NULL if no communication is available.
Positioner Primary Angle	(0018,1510)	Sent with value available from X-ray generator via RS-232 interface. Value will be NULL if no communication is available.
Positioner Secondary Angle	(0018,1511)	Sent with value available from X-ray generator via RS-232 interface. Value will be NULL if no communication is available.
VOI LUT Module		
Window Center	(0028,1050)	
Window Width	(0028,1051)	
SOP Common Module		
SOP Class UID	(0008,0016)	1.2.840.10008.5.1.4.1.1.12.1
SOP Instance UID	(0008,0018)	Internally generated by ADR
Specific Character Set	(0008,0005)	- / "ISO_IR 100" / NULL + "ISO 2022 IR 87

(1) Used only if a shutter shape is defined when the image is created

(2) Used only if a collimator shape is defined when the image is created

3.1.4.6 XRF IOD Information Object Definition

The following table denotes the attributes included in the RF Image Object as implemented on the ADR system. Attributes **not** listed are **not** used.

Table VIII: RF IOD Attributes

Attribute Name	Tag	Notes
Patient Module		
Patient Name	(0010,0010)	From Patient Registration screen. Value is set to NULL if no patient name is specified.
Patient ID	(0010,0020)	From Patient Registration screen. This field should always be specified.
Patient Birth Date	(0010,0030)	From Patient Registration screen. Value is set to NULL if no birth date is specified.
Patient Sex	(0010,0040)	From Patient Registration screen. Value is set to NULL if no patient sex is specified.
Referenced Patient Sequence	(0008,1120)	This information is present only if retrieved from the MWM server.
>Referenced SOP Class UID	(0008,1150)	
>Referenced Instance UID	(0008,1155)	
Patient Comments	(0010,4000)	As received from the MWM server.
General Study Module		
Study Instance UID	(0020,000D)	From MWM server or internally generated.
Study Date	(0008,0020)	Date the study number is generated.
Study Time	(0008,0030)	Time the study number is generated..
Referring Physician's Name	(0008,0090)	From Patient Registration screen. May be edited by the user.
Study ID	(0020,0010)	Internally generated by the ADR.
Accession Number	(0008,0050)	From MWM server or internally generated. This information is present only if the MWM service is enabled.
Referenced Study Sequence	(0008,1110)	Sent if the tag is received from the MWM server.
>Referenced SOP Class UID	(0008,1150)	
>Referenced SOP Instance UID	(0008,1155)	
General Series Module		
Modality	(0008,0060)	RF
Series Instance UID	(0020,000E)	Internally generated by the ADR.
Series Number	(0020,0011)	Internally generated by the ADR.
Series Date	(0008,0021)	
Series Time	(0008,0031)	

Performing Physician's Name	(0008,1050)	From Patient Registration screen. May be edited by the user.
Protocol Name	(0018,1030)	ADR study name. Selected by the user.
Series Description	(0008,103E)	Series label. May be edited by the user.
Body Part Examined	(0018,0015)	From Patient Registration screen. May be edited by the user. Value is set to NULL if no body part is specified.
Requested Attributes Sequence	(0040,0275)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
> Requested Attributes ID	(0040,1001)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>Scheduled Procedure Step ID	(0040,0009)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>Scheduled Procedure Step Description	(0040,0007)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>Scheduled Action Item Code Sequence	(0040,0008)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>>Code Value	(0008,0100)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>>Coding Scheme Designator	(0008,0102)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>>Coding Scheme Version	(0008,0103)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>>Coding Meaning	(0008,0104)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
Performed Procedure Step ID	(0040,0253)	ADR internal study name. Selected by the user.
Performed Procedure Step Start Date	(0040,0244)	
Performed Procedure Step Start Time	(0040,0245)	
Performed Procedure Step Description	(0040,0254)	From Patient Registration screen. May be edited by the user.
Performed Action Item Code Sequence	(0040,0260)	Always NULL.

General Equipment Module		
Manufacturer	(0008,0070)	
Institution Name	(0008,0080)	Hospital Name (for each image)
Station Name	(0008,1010)	From Configuration Utility (name + location).
Manufacturer's Model Name	(0008,1090)	Name displayed on the system's welcome screen.
Device Serial Number	(0018,1000)	Sent for ADR-1000A/R1 and ADR-1000A/R2 systems.
General Image Module		
Instance Number	(0020,0013)	Internally generated from ADR.
Patient Orientation	(0020,0020)	Always NULL.
Content Date	(0008,0023)	
Content Time	(0008,0033)	
Image Type	(0008,0008)	ORIGINAL/DERIVED. PRIMARY/SECONDARY. SINGLE PLANE.
Derivation Description	(0008,2111)	Sent only if (0008,0008) is DERIVED.
Image Comments	(0020,4000)	
Burned in Annotation	(0028,0301)	YES or NOT, depending on whether the relevant option was selected via the ADR's DICOM setup menu.
Lossy Image Compression	(0028,2110)	Set to 00.
Image Pixel Module		
Samples Per Pixels	(0028,0002)	Set to 1.
Photometric Interpretation	(0028,0004)	Set to Monochrome 2.
Rows	(0028,0010)	Set to 1024, 2048 or 4096.
Columns	(0028,0011)	Set to 1024 or 1280.
Bits Allocated	(0028,0100)	Set to 8 Bit for Fluoroscopy or 16 Bit for Photospot.
Bits Stored	(0028,0101)	Set to 8 or 10.
High Bit	(0028,0102)	Set to 7 or 9.
Pixel Representation	(0028,0103)	Set to 0000H.
Pixel Data	(7FE0,0010)	
X-Ray Image Module		
Lossy Image Compression	(0028,2110)	Set to 00.
Image Type	(0008,0008)	ORIGINAL/DERIVED. PRIMARY/SECONDARY. SINGLE PLANE.

Pixel Intensity Relationship	(0028,1040)	DISP/LIN.
Samples Per Pixel	(0028,0002)	Set to 1.
Photometric Interpretation	(0028,0004)	Set to Monochrome 2.
Bits Allocated	(0028,0100)	Set to 8 Bit for Fluoroscopy or 16 Bit for Photospot.
Bits Stored	(0028,0101)	Set to 8 or 10.
High Bit	(0028,0102)	Set to 7 or 9.
Pixel Representation	(0028,0103)	Set to 0000H.
Derivation Description	(0008,2111)	Sent only if (0008,0008) is DERIVED.
Scan Options	(0018,0022)	Sent only for TOMO images.

X-Ray Acquisition Module

KVP	(0018,0060)	Sent with value available from X-ray generator via RS-232 interface. Value will be NULL if no communication is available.
Radiation Setting	(0018,1155)	GR for photospot images. SC for fluoroscopy images.
X Ray Tube Current	(0018,1151)	Sent with value available from X-ray generator via RS-232 interface. Value will be NULL if no communication is available.
Exposure Time	(0018,1150)	Sent with value available from X-ray generator via RS-232 interface. Value will be NULL if no communication is available.
Intensifier Size	(0018,1162)	Diameter of X-ray intensifier in mm.
Field of View shape	(0018,1147)	Set to ROUND.

Display Shutter Module ⁽¹⁾

Shutter Shape	(0018,1600)	Always RECTANGULAR
Left Vertical Edge	(0018,1602)	
Right Vertical Edge	(0018,1604)	
Upper Horizontal Edge	(0018,1606)	
Lower Horizontal Edge	(0018,1608)	

Collimator Module ⁽²⁾

Collimator Shape	(0018,1700)	Always RECTANGULAR
Left Vertical Edge	(0018,1702)	
Right Vertical Edge	(0018,1704)	
Upper Horizontal Edge	(0018,1706)	

XRF Positioner Module		
Distance Source to Detector	(0018,1110)	Sent with value available from X-ray generator via RS-232 interface. Value will be NULL if no communication is available.
VOI LUT Module		
Window Center	(0028,1050)	
Window Width	(0028,1051)	
TOMOGRAPHY Acquisition Module		
Tomo Layer height	(0018,1460)	Sent only if (0018,0022) is TOMO.
Tomo Angle	(0018,1470)	Sent only if (0018,0022) is TOMO.
SOP Common Module		
SOP Class UID	(0008,0016)	1.2.840.10008.5.1.4.1.1.12.2
SOP Instance UID	(0008,0018)	Internally generated by ADR
Specific Character Set	(0008,0005)	- / "ISO_IR 100" / NULL + "ISO 2022 IR 87

(1) Used only if a shutter shape is defined when the image is created

(2) Used only if a collimator shape is defined when the image is created

3.1.4.7 Secondary Capture IOD Information Object Definition

The following table denotes the attributes included in the SC Image Object as implemented on the ADR system. Attributes **not** listed are **not** used.

Table IX: SC IOD Attributes

Attribute Name	Tag	Notes
Patient Module		
Patient Name	(0010,0010)	From Patient Registration screen. Value is set to NULL if no patient name is specified.
Patient ID	(0010,0020)	From Patient Registration screen. This field should always be specified.
Patient Birth Date	(0010,0030)	From Patient Registration screen. Value is set to NULL if no birth date is specified.
Patient Sex	(0010,0040)	From Patient Registration screen. Value is set to NULL if no patient sex is specified.
Referenced Patient Sequence	(0008,1120)	This information is present only if retrieved from the MWM server.
>Referenced SOP Class UID	(0008,1150)	
>Referenced Instance UID	(0008,1155)	
Patient Comments	(0010,4000)	As received from the MWM server.
General Study Module		
Study Instance UID	(0020,000D)	From MWM server or internally generated.
Study Date	(0008,0020)	Date the study number is generated.
Study Time	(0008,0030)	Time the study number is generated..
Referring Physician's Name	(0008,0090)	From Patient Registration screen. May be edited by the user.
Study ID	(0020,0010)	Internally generated by the ADR.
Accession Number	(0008,0050)	From MWM server or internally generated. This information is present only if the MWM service is enabled.
Referenced Study Sequence	(0008,1110)	Sent if the tag is received from the MWM server.
>Referenced SOP Class UID	(0008,1150)	
>Referenced SOP Instance UID	(0008,1155)	
General Series Module		
Modality	(0008,0060)	OT or XA or RF
Series Instance UID	(0020,000E)	Internally generated by the ADR.
Series Number	(0020,0011)	Internally generated by the ADR.
Series Date	(0008,0021)	
Series Time	(0008,0031)	

Performing Physician's Name	(0008,1050)	From Patient Registration screen. May be edited by the user.
Protocol Name	(0018,1030)	ADR study name. Selected by the user.
Series Description	(0008,103E)	Series label. May be edited by the user.
Body Part Examined	(0018,0015)	From Patient Registration screen. May be edited by the user. Value is set to NULL if no body part is specified.
Requested Attributes Sequence	(0040,0275)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
> Requested Attributes ID	(0040,1001)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>Scheduled Procedure Step ID	(0040,0009)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>Scheduled Procedure Step Description	(0040,0007)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>Scheduled Action Item Code Sequence	(0040,0008)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>>Code Value	(0008,0100)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>>Coding Scheme Designator	(0008,0102)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>>Coding Scheme Version	(0008,0103)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
>>Coding Meaning	(0008,0104)	Sent if the tag is received from the MWM server. This information is present only if the MWM service is enabled.
Performed Procedure Step ID	(0040,0253)	ADR internal study name. Selected by the user.
Performed Procedure Step Start Date	(0040,0244)	
Performed Procedure Step Start Time	(0040,0245)	
Performed Procedure Step Description	(0040,0254)	From Patient Registration screen. May be edited by the user.
Performed Action Item Code Sequence	(0040,0260)	Always NULL.

General Equipment Module

Manufacturer	(0008,0070)	
Institution Name	(0008,0080)	Hospital Name (for each image)
Station Name	(0008,1010)	From Configuration Utility (name + location).
Manufacturer's Model Name	(0008,1090)	Name displayed on the system's welcome screen.
Device Serial Number	(0018,1000)	Sent for ADR-1000A/R1 and ADR-1000A/R2 systems.
Conversion Type	(0008,0064)	Set to DI

General Image Module

Instance Number	(0020,0013)	Internally generated from ADR.
Patient Orientation	(0020,0020)	Always NULL.
Content Date	(0008,0023)	
Content Time	(0008,0033)	
Image Type	(0008,0008)	Always DERIVED, SECONDARY and SINGLE PLANE
Image Comments	(0020,4000)	
Burned in Annotation	(0028,0301)	YES or NOT, depending on whether the relevant option was selected via the ADR's DICOM setup menu.
Lossy Image Compression	(0028,2110)	Set to 00.

Image Pixel Module

Samples Per Pixels	(0028,0002)	Set to 1.
Photometric Interpretation	(0028,0004)	Set to Monochrome 2.
Rows	(0028,0010)	Set to 1024, 2048 or 4096.
Columns	(0028,0011)	Set to 1024 or 1280.
Bits Allocated	(0028,0100)	Set to 8 Bit for Fluoroscopy or 16 Bit for Photospot.
Bits Stored	(0028,0101)	Set to 8 or 10.
High Bit	(0028,0102)	Set to 7 or 9.
Pixel Representation	(0028,0103)	Set to 0000H.
Pixel Data	(7FE0, 0010)	

SC Ray Image Module

Date of Secondary Capture	(0018,1012)	
Time of Secondary Capture	(0018,1014)	

VOI LUT Module

Window Center	(0028,1050)	
Window Width	(0028,1051)	

SOP Common Module

SOP Class UID	(0008,0016)	1.2.840.10008.5.1.4.1.1.7
SOP Instance UID	(0008,0018)	Internally generated by ADR
Specific Character Set	(0008,0005)	- / “ISO_IR 100” / NULL + “ISO 2022 IR 87

3.1.5 Real-World Activity – Print (SCU)

The ADR can be configured to **automatically** send the images at the end of the examination. In this case, when the user selects “New Patient”, an association is opened and all acquired images are transferred. After all images are transferred, the association is closed.

The ADR user can **manually** send selected images at any time. An association is opened and all selected images are transferred. After all images are transferred, the association is closed.

3.1.5.1 Associated Real-World Activities

An association is established when the user initiates a “Print” operation from either the “Film Previewer” or the “Extended FOV” applications.

Individual images or entire examinations can be transferred to the DICOM - compliant device. The association is opened when the first selected image is transferred and closed when the last image transfer is completed. In case an error occurs during the printing process, the operator can manually attempt to resend the film at a later stage.

3.1.5.2 Proposed Presentation Context

ADR will use the Presentation Context shown in the following table:

Table X: Print Presentation Context Table

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

3.1.5.3 Specific Conformance to Basic Grayscale Print Management Meta SOP Class

The Print AE provides standard conformance of the Grayscale Meta SOP class as an SCU. Specifically, with respect to the Basic Grayscale Print Management Meta SOP Class, this means conformance to the underlying SOP classes:

Table XI: Supported SOP Classes

SOP Class Name	SOP Class UID	Conformance Level
Basic Film Session SOP Class	1.2.840.100008.5.1.1.1	Standard
Basic Film Box SOP Class	1.2.840.100008.5.1.1.2	Standard
Basic Grayscale Image Box SOP Class	1.2.840.100008.5.1.1.4	Standard
Printer SOP Class	1.2.840.100008.5.1.1.16	Standard

The ADR provides standard conformance to the DICOM V3.0 Verification Service Class as an SCU for the Verification Class, UID = 1.2.840.10008.1.1.

3.1.5.4 Specific Conformance – Print

The ADR AE operation involves the following sequence of steps for each film print:

1. N – GET (Printer SOP Instance)
2. N – CREATE (Film Session SOP Instance)
 - The command is sent only once.
 - A response without any data but with the status SUCCESS is expected.
3. N – CREATE (Film Box SOP Instance)
 - The command is sent only once.
 - A response with status SUCCESS is expected from the SCP containing the following items:
 - a. (2110,0510) Referenced Image Box Sequence
 - b. >(0008,1150) SOP Class UID (Ignored by SCU)
 - c. >(0008,1155) SOP Instance UID
 - The received SOP Instance UIDs are stored in an array and later used when sending individual images.
4. N – SET (Grayscale Image Box SOP Instance)
 - The command is sent once for each image on the film.
 - A response without any data but with the status SUCCESS is expected.
5. N – ACTION (Film Box SOP Instance)
 - The command is transmitted to the SCP without any data but indicating that the PRINT operation is to be performed. The command is sent only once.
 - A response without any data but with status SUCCESS is expected.
6. N-DELETE
 - Deletes the Film Session. Issued after the session is completed.

3.1.5.5 AE Title/Presentation Address Mapping

This mapping is defined during the ADR installation procedure.

Both the local and remote names can be arbitrary defined. Local AE Titles for the different services should be different.

3.1.5.6 Specific Conformance to Basic Film Session SOP Class

Table XII: Supported Basic Film Session SOP Class Elements

Attribute Name	Tag	Usage ¹	Range	Description
Number of Copies	(2000,0010)	U	1-99	Number of requested film copies
Print Priority	(2000,0020)	C	HIGH, MED, LOW	Set at configuration.
Medium Type	(2000,0030)	U	CLEAR FILM BLUE FILM PAPER	Media used for hardcopy.
Film Destination	(2000,0040)	U	MAGAZINE PROCESSOR	
Film Session Label	(2000,0050)	A	Always sent as NULL	

¹ A: Attribute always sent with value not editable.

C: Attribute sent with value set in the configuration screen.

U: Attribute sent with value set by user.

3.1.5.7 Specific Conformance to Basic Film Box SOP Class

Table XIII: Optional Attributes set for the Basic Film Box SOP Class

Attribute Name	Tag	Usage ¹	Range	Description
Image Display Format	(2010,0010)	U	1/2/4/6/9/20	
Referenced Film Session Sequence	(2010,0500)	A		
>Referenced SOP Class UID	(0008,1150)	A		
>Referenced SOP Instance UID	(0008,1155)	A		
Film Orientation	(2010,0040)	U	LANDSCAPE PORTRAIT	

Film Size ID	(2010,0050)	U	8INX10IN 8.5INX11IN 10INX12IN 10INX14IN 11INX14IN 11INX17IN 14INX14IN 14INX17IN 24CMX24CM 24CMX30CM	
Magnification Type	(2010,0060)	U	REPLICATE BILINEAR CUBIC NONE	
Max Density	(2010,0130)	U	1.5 – 3.2	Printer Specific
Smoothing Type	(2010,0080)	U	Value set at installation.	Printer Specific. Sent only in CUBIC magnification.
Border Density	(2010,0100)	U	BLACK WHITE i	Where i represents the desired image density in tenths of OD.
Empty Image Density	(2010,0110)	U	BLACK WHITE i	Where i represents the desired image density in tenths of OD
Min Density	(2010,0120)	U	0-1	Printer specific
Trim	(2010,0140)	U	YES NO	
Configuration Information	(2010,0150)	U	Value set at installation.	Printer Specific

¹ A: Attribute always sent with value not editable.

C: Attribute sent with value set in the configuration screen.

U: Attribute sent with value set by user.

3.1.5.8 Specific Conformance to Basic Grayscale Image SOP Class

Table XIV: Optional Attributes set for the Basic Grayscale Image Box SOP Class

Attribute Name	Tag	Usage ¹	Range	Description
Image Position	(2020,0010)	A	1 – N	Depends on the Image Display format chosen.
Basic Grayscale Image Sequence	(2020,0110)	A		
>Samples Per Pixel	(0028,0002)	A	Set to 1	
>Photometric Interpretation	(0028,0004)	A	Monochrome 2	
>Rows	(0028,0010)	A	Set to 1024, 2048 or 4096	2048 and 4096 resolutions are used for E-FOV images.
>Columns	(0028,0011)	C	1024-1280	Selectable via ADR internal software keys.
>Pixel Aspect Ratio	(0028,0034)	A	Set to 1\1	
>Bits Allocated	(0028,0100)	A	Set to 8	
>Bits Stored	(0028,0101)	A	Set to 8	
>High Bit	(0028,0102)	A	Set to 7	
>Pixel Representation	(0028,0103)	A	Set to 0000H	
>Pixel Data	(7FE0,0010)	A		
Polarity	(2020,0020)	A	Set to NORMAL	
Magnification Type	(2010,0060)	U	REPLICATE BILINEAR CUBIC NONE	
Smoothing Type	(2010,0080)	U	Value set at installation.	Printer Specific. Same value as in FILM BOX.
Configuration Information	(2010,0150)	U	Value set at installation.	Printer Specific. Same value as in FILM BOX.

¹ A: Attribute always sent with value not editable.

C: Attribute sent with value set in the configuration screen.

U: Attribute sent with value set by user.

Table XV: Supported SOP Class Elements

Attribute Name	Tag	Description
Printer Status	(2110,0010)	The behavior depends on the returned value: NORMAL: Association goes on. WARNING: Association goes on. FAILURE: Association is aborted.
Printer Status Info	(2110,0020)	Printer shall return error message. Error is displayed on the ADR's Printer Queue.
Printer Name	(2110,0030)	Printer shall return value.
Manufacturer	(0008,0070)	Printer shall return value.
Manufacturer Model Name	(0008,1090)	Printer shall return value.
Device Serial Number	(0018,1000)	Printer shall return value.
Software Versions	(0018,1020)	Printer shall return value.
Date of Last Calibration	(0018,1200)	Printer shall return value.
Time of Last Calibration	(0018,1201)	Printer shall return value

3.1.6 Real-World Activity – MWM (SCU)

The user requests a patient's list from the "Query IS" in the "Patient Registration Screen". When the operator retrieves the patient information list, the ADR establishes an association with the remote DICOM device.

3.1.6.1 Associated Real-World Activities

An association is established when the user initiates a "Query IS" operation from the ADR "Patient Registration" screen.

Individual Patients or a group of patients can be registered from the Modality Worklist Management server. The association is opened when the user requests the patient information list and completed when all requested information is transferred.

3.1.6.2 Proposed Presentation Context

The ADR will use the Presentation Context shown in the following table:

Table XVI: Worklist Presentation Context Table

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Worklist Information Model -FIND	1.2.840.10008.5.1.4.31	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Modality Worklist Information Model -FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Modality Worklist Information Model -FIND	1.2.840.10008.5.1.4.31	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

3.1.6.3 Specific Conformance – MWM

The ADR AE operation involves the following sequence of steps for each patient list transfer:

1. Association establishment (requestor only)
2. Data transfer
3. Association release

The ADR AE judges that the query was successful when the result of step (2) above is “success”.

3.1.6.4 AE Title/Presentation Address Mapping

This mapping is defined during the ADR installation procedure.

Both the local and remote names can be arbitrary defined. Local AE Titles for the different services should be different.

3.1.6.5 Specific Conformance to Modality Worklist Service SOP Class

The Worklist AE provides conformance to the following DICOM Service SOP Classes as an SCU all at a standard extended level of conformance.

Table XVII: Supported SOP Classes

SOP Class Name	SOP Class UID	Conformance Level
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Standard Extended

3.1.6.6 Modality Worklist Find SOP Class Information Object Definition

The following table provides the list of attributes requested in the Modality Worklist Query.

Request of most of the listed attributes depends on an internal software key that may be configured by the Installation/Service Engineer.

Table XVIII: Modality Worklist Information Model Attributes

Attribute Name	Tag	Notes
SOP Common Module		
Specific Character Set	(0008,0005)	<ul style="list-style-type: none"> • ISO-IR 100 character set (Latin Alphabet) • ISO-IR 87 JIS X 0208 (Kanji) .
Scheduled Procedure Step Module		
Scheduled Procedure Step Sequence	(0040,0100)	
>Scheduled Station AE Title	(0040,0001)	
>Scheduled Procedure Start Date	(0040,0002)	See Note 2.
>Scheduled Procedure Start Time	(0040,0003)	
>Modality	(0008,0060)	RF or XA.
>Scheduled Performing Physician's Name	(0040,0006)	Used as Study Physician in the Patient Registration Screen.
>Scheduled Procedure Step Description	(0040,0007)	This attribute or (0032,1060) is used as Requested Procedure in the Patient Registration Screen.
>Scheduled Station Name	(0040,0010)	See Note 2
>Scheduled Procedure Step Location	(0040,0011)	
>Scheduled Action Item Code Sequence	(0040,0008)	
>>Code Value	(0008,0100)	
>>Coding Scheme Designator	(0008,0102)	
>>Coding Scheme Version	(0008,0103)	
>>Coding Meaning	(0008,0104)	
>Pre-Medication	(0040,0012)	
>Scheduled Procedure Step ID	(0040,0009)	
>Requested Contrast Agent	(0032,1070)	
Requested Procedure Module		
Requested Procedure ID	(0040,1001)	
Requested Procedure Description	(0032,1060)	
Requested Procedure Code Sequence	(0032,1064)	
>Code Value	(0008,0100)	
>Coding Scheme Designator	(0008,0102)	
>Coding Scheme Version	(0008,0103)	

>Coding Meaning	(0008,0104)	
Study Instance UID	(0020,000D)	
Referenced Study Sequence	(0008,1110)	
>Referenced SOP Class UID	(0008,1150)	
>Referenced SOP Instance UID	(0008,1155)	
Requested Procedure Comments	(0040,1400)	Requested Procedure Comments
Names of Intended Recipients of Results	(0040,1010)	Names of Intended Recipients of Results
Requesting Service	(0032,1033)	Requesting Service
Imaging Service Request Module		
Accession Number	(0008,0050)	See Note 2.
Requesting Physician	(0032,1032)	This attribute or (0008,0090) is used as Referring Physician in the Patient Registration Screen.
Referring Physician's Name	(0008,0090)	
Imaging Service Request Comments	(0040,2400)	
Referred Patient Sequence	(0008,1120)	
>Referenced SOP Class UID	(0008,1150)	
>Referenced SOP Instance UID	(0008,1155)	
Patient Identification Module		
Patient's Name	(0010,0010)	See Note 2.
Patient ID	(0010,0020)	A response with data is expected from the MWM server. See Note 2.
Other Patient IDs	(0010,1000)	
Visit Identification Module		
Current Patient Location	(0038,0300)	
Patient Demographic Module		
Patient Birth Date	(0010,0030)	
Patient Sex	(0010,0040)	
Ethnic Group	(0010,2160)	
Patient Comment	(0010,4000)	
Patient Medical Module		
Pregnancy Status	(0010,21C0)	
Medical Alerts	(0010,2000)	
Additional Patient History	(0010,21B0)	

² Used as Query Criteria.

3.1.7 Real-World Activity – MPPS (SCU)

This operation enables the AE to create an instance of the Modality Performed Procedure step SOP Class (MPPS) and provide information about a specific real word Performed Procedure step that is under control of the SCU. This operation is invoked through the DIMSE N-CREATE and N-SET services.

Starting a Performed Procedure Step

The user registers a “New Patient” at the start of each new patient examination. When a new patient examination starts, a PPS (Performed Procedure Step) instance is created and automatically transferred to a remote DICOM device. This instance will be created using the N-CREATE DIMSE service for the selected scheduled procedure.

Ending a Performed Procedure Step

When the user selects either “Completed” or “Discontinued” from the PPS User Interface, the performed procedure step will be closed using the N-SET DIMSE service. Once this event has been sent, no more images will be transferred referencing the schedule procedure.

New Query Request

If the “Query IS” button is selected and there are pending performed procedure steps, the user shall be prompted for a closure status for each pending procedure step by the PPS User Interface. All “pending” procedures must be closed before a new query can be performed.

System Shutdown

If the user selects the “System Logoff” option and there is an opened performed procedure steps, the PPS User Interface will prompt the user to close it. The opened procedure steps must be closed before the system can be shutdown.

Error handling

If at any time the MPPS is unavailable, the “Queue Manager” icon will be lit, thus indicating the user that there are pending commands to be sent to the server.

No automatic data transfer will be attempted, and user’s intervention will be necessary in order to transfer the pending commands to the server.

3.1.7.1 Proposed Presentation Context

The ADR will use the Presentation Context shown in the following table.

Table XIX: Modality Performed Procedure Step Presentation Context Table

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

3.1.7.2 Specific Conformance – MPPS

The ADR AE operation involves the following sequence of steps for examination results transfer:

1. Association establishment
2. Data transfer
3. Association release

The ADR AE judges that the transfer of examination results was successful when the result of step (2) above is “success”, even if the result of step (3) is “failure”.

3.1.7.3 AE Title/Presentation Address Mapping

This mapping is defined during the ADR installation procedure.

Both the local and remote names can be arbitrary defined. Local AE Titles for the different services should be different.

3.1.7.4 Specific Conformance to Modality Performed Procedure Step SOP Classes

The Modality Performed Procedure Step AE provides conformance to the following DICOM Service SOP Classes as an SCU all at a standard extended level of conformance.

Table XX: Supported SOP Classes

SOP Class Name	SOP Class UID	Conformance Level
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Standard

3.1.7.5 Modality Performed Procedure Step SOP Class Information Object Definition

The following table provides the list of attributes supported by the AE in the implementation of the N-CREATE and N-SET commands.

The usage of most of the listed attributes depends on an internal software key that may be configured by the Installation/Service Engineer.

Table XXI: Attributes of the N-CREATE command

Attribute Name	Tag	Notes
SOP Common Module		
Specific Character Set	(0008,0005)	<ul style="list-style-type: none"> • ISO-IR 100 character set (Latin Alphabet) • ISO-IR 87 JIS X 0208 (Kanji) .
Performed Procedure Step Relationship Module		
Scheduled Step Attributes Sequence	(0040,0270)	
>Study Instance UID	(0020,000D)	From the MWM server or internally generated by the ADR.
>Referenced Study Sequence	(0008,1110)	
>>Referenced SOP Class UID	(0008,1150)	
>>Referenced SOP Instance UID	(0008,1155)	
>Accession Number	(0008,0050)	From the MWM server or internally generated by the ADR.
>Requested Procedure ID	(0040,1001)	
>Requested Procedure Description	(0032,1060)	
>Scheduled Procedure Step ID	(0040,0009)	Always NULL.
>Scheduled Procedure Step Description	(0040,0007)	
>Scheduled Action Item Code Sequence	(0040,0008)	
>Code Value	(0008,0100)	
>Coding Scheme Designator	(0008,0102)	
>Coding Scheme Version	(0008,0103)	
>Coding Meaning	(0008,0104)	
Patient's Name	(0010,0010)	
Patient ID	(0010,0020)	From the ADR Patient Registration Screen.
Patient's Birth Date	(0010,0030)	From the ADR Patient Registration Screen.

Patient's Sex	(0010,0040)	From the ADR Patient Registration Screen.
Referenced Patients Sequence	(0008,1120)	
>Referenced SOP Class UID	(0008,1150)	
>Referenced Instance UID	(0008,1155)	
Performed Procedure Step ID	(0040,0253)	
Performed Station AE Title	(0040,0241)	
Performed Station Name	(0040,0242)	
Performed Location	(0040,0243)	
Performed Procedure Step Start Date	(0040,0244)	
Performed Procedure Step Time	(0040,0245)	
Performed Procedure Step Status	(0040,0252)	IN PROGRESS
Performed Procedure Step Description	(0040,0254)	From the ADR Patient Registration Screen.
Performed Procedure Type Description	(0040,0255)	Study Type in the ADR.
Procedure Code Sequence	(0008,1032)	
>Code Value	(0008,0100)	
>Coding Scheme Designator	(0008,0102)	
>Coding Scheme Version	(0008,0103)	
>Coding Meaning	(0008,0104)	
Performed Procedure Step End Date	(0040,0250)	Always NULL.
Performed Procedure Step End Time	(0040,0251)	Always NULL.
Image Acquisition Results Module		
Modality	(0008,0060)	From MWM or according to ADR Study Type.
Study ID	((0020,0010)	Always NULL.
Performed Action Item Code Sequence	(0040,0260)	Always NULL.
Performed series sequence	(0040,0340)	Always NULL.

Table XXII: Attributes of the N-SET command

Attribute Name	Tag	Notes
Performed Procedure Step Module		
Performed Procedure Step Status	(0040,0252)	DISCONTINUED/COMPLETED
Performed Procedure Step Description	(0040,0254)	From ADR Patient Registration Screen.
Performed Procedure Type Description	(0040,0255)	Study Type in ADR.
Procedure Code Sequence	(0008,1032)	
>Code Value	(0008,0100)	
>Coding Scheme Designator	(0008,0102)	
>Coding Scheme Version	(0008,0103)	
>Coding Meaning	(0008,0104)	
Performed Procedure Step End Date	(0040,0250)	
Performed Procedure Step End Time	(0040,0251)	
Image Acquisition Results Module		
Performed Action Item Code Sequence	(0040,0260)	
>Code Value	(0008,0100)	
>Coding Scheme Designator	(0008,0102)	
Performed Series Sequence	(0040,0340)	
>Performing Physician's Name	(0008,1050)	
>Protocol Name	(0018,1030)	Study Name in the ADR.
>Operators Name	(0008,1070)	Always NULL.
>Series Instance UID	(0020,000E)	Internally Generated by the ADR.
>Series Description	(0008,103E)	Series label.
>Retrieve AE Title	(0008,0054)	Always NULL.
>Referenced Image Sequence	(0008,1140)	
>>Referenced SOP Class UID	(0008,1150)	
>>Referenced SOP Instance UID	(0008,1155)	
>Referenced Standalone SOP Instance Sequence	(0040,0220)	Always NULL.

Radiation Dose Module		
Total Time Of Fluoroscopy	(0040,0300)	Sent if available from X-ray Generator via RS-232 interface. Will not be sent if no RS-232 communication is available.
Total Number Of Exposures	(0040,0301)	
Distance Source To Detector (SID)	(0018,1110)	Sent if available from X-ray Generator via RS-232 interface. Will not be sent if no RS-232 communication is available.

3.1.8 Real-World Activity – Storage Commitment (SCU)

3.1.8.1 Associated Real-World Activities

After images are being transferred to one predefined and unique DICOM Store SCP, the ADR establishes an association with a Storage Commitment SCP which is collaborated with the above Store SCP.

3.1.8.2 Proposed Presentation Context

The ADR will use the Presentation Context shown in the following table.

Table XXIII: Modality Performed Procedure Step Presentation Context Table

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Storage Commitment Push Model	1.2.840.10008.1.20.1	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

3.1.8.3 Specific Conformance – Storage Commitment

Table XXIV: Supported SOP Classes

SOP Class Name	SOP Class UID	Conformance Level
Storage Commitment Push Model	1.2.840.10008.1.20.1	Standard

The ADR AE operation involves the following sequence of steps for safe keeping requests transfer:

1. Association establishment
2. Data transfer
3. Association release

The ADR AE judges that the transfer of examination results was successful when the result of step (2) above is “success”, even if the result of step (3) is “failure”.

3.1.8.4 AE Title/Presentation Address Mapping

This mapping is defined during the ADR installation procedure.

3.1.8.5 Storage Commitment Push Model SOP Class Information Object Definition

The following table provides the list of attributes supported by the AE in the implementation of the N-ACTION and N-EVENT-REPORT commands.

Table XXV: Attributes of the N-ACTION command

Attribute Name	Tag	Notes
Transaction UID	(0008,1195)	Generated by the ADR
Referenced SOP sequence	(0008,1199)	List of SOP Instance UID of images – ACTION TYPE ID is 1
> Referenced SOP Class UID	(0008,1150)	
> Referenced SOP Instance UID	(0008,1155)	
Referenced Study Component sequence	(0008,1111)	SOP Instance UID of MPPS
> Referenced SOP Class UID	(0008,1150)	
> Referenced SOP Instance UID	(0008,1155)	

Table XXVI: Attributes of the N-EVENT-REPORT command

Attribute Name	Tag	Notes
Transaction UID	(0008,1195)	Generated by the ADR
Referenced SOP sequence	(0008,1199)	EVENT TYPE ID is 1 or 2
> Referenced SOP Class UID	(0008,1150)	
> Referenced SOP Instance UID	(0008,1155)	

Failed SOP sequence	(0008,1198)	EVENT TYPE ID is 2
> Referenced SOP Class UID	(0008,1150)	
> Referenced SOP Instance UID	(0008,1155)	
> Failure Reason	(0008,1197)	

3.1.9 Real-World Activity – Media Storage (FSU)

3.1.9.1 Associated Real-World Activities

N/A

3.1.9.2 Supported Application Profile

The ADR will use the Presentation Context shown in the following table.

Table XXVII: M Presentation Context Table

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Media Storage Directory Storage	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1	FSC	None
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	FSC	None
X-Ray RF Image Store	1.2.840.10008.5.1.4.1.1.12.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	FSC	None
Secondary Capture Image Store	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1	FSC	None

3.1.9.3 Specific Conformance – Media storage AE

All specific conformance to image IODs is the same as in STORE AE specific conformance

3.1.9.4 AE Title

The AE title for Media Storage is “ADR_STORAGE_SCU”

4. Communication Profiles

4.1 TCP/IP Stack

Each process inherits its TCP/IP stack from the operating system TCP/IP stack of the ADR system.

4.2 Physical Media Support

Standard representations of IEEE 802.3 (10BASE2 (“thinwire”), Fiber Optic (both SMA and ST style connectors) and 10BaseT (“twisted pair”)) are supported and the system interfaces and transceivers configured to meet customer site-specific requirements.

5. Configuration

The ADR Networking and DICOM parameters can be configured through the system's DICOM Configuration screen (available to the Service Engineer only) and the set-up menus (available to both, the Service Engineer and the User). The following configuration is supported:

- Basic System Configuration
- Network
- DICOM Store and Media Storage.
- DICOM Print.
- DICOM Worklist.
- DICOM Modality Performed Procedure Set
- DICOM Storage Commitment.
- Study types.

5.1 Basic System Configuration

The following system parameters can be configured via the ADR System DICOM configuration screen or the set-up menu:

- Hospital Name
- Station Name
- Station Location

5.1.1 Hospital Name

The user can enter the Hospital Name as a text string in the relevant field in the Acquisition set-up menu. The Hospital Name is transferred to DICOM devices as Institution name, DICOM data element (0008,0080).

5.1.2 Station Name

The Service Engineer can enter the name of the station where the examination is going to be performed in the DICOM Configuration screen. The station name will be transferred to DICOM devices as Station Name, DICOM data element (0040,0010).

5.1.3 Station Location

The Service Engineer can enter the name of the location where the examination is going to be performed in the DICOM Configuration screen. The station name will be transferred to DICOM devices as Station Name, DICOM data element (0040,0011).

5.2 DICOM Network Configuration

The ADR network parameters are configurable. The following network parameters can be configured for the ADR system:

- Host Name

- IP address
- DICOM Application Entity (for each service)
- Network time-out (for each service)

5.3 DICOM Store Configuration

Remote DICOM Storage service class providers (up to 10) are provided through the DICOM-Store page of the DICOM Configuration menu (available to the Service Engineer only).

The following parameters can be configured:

- Number of Remote Servers.
- Local AE.
- Communication time out.
- Remote Station displayed name.
- Remote AE.
- Host Address.
- Remote Port Number.

Images may be **automatically** transferred to any of the configured remote stations either by clicking a relevant icon in the ADR's Acquisition application or upon registration of a new patient.

Selection of manual or automatic transfer of images to the remote station is user-selectable.

5.4 DICOM Print Configuration

Remote DICOM –compliant printers (up to 10) are provided through the DICOM-Print page of the DICOM Configuration menu (available to the Service Engineer only).

The following parameters can be configured:

- Number of Printers.
- Local AE.
- Communication time out.
- Printer name.
- Remote AE.
- Host Address.
- Remote Port Number.
- Pixel Resolution.

The following data is configurable by the user via the DICOM Print setup menu. The user can change each field at any time during the operation of the ADR system. The effect of changing the parameters of the DICOM Print sever will be seen on the next film sheet.

The user-configurable parameters are described in Table XI of this Conformance Statement.

5.5 DICOM Worklist Configuration

A remote DICOM Worklist Service Class Providers can be configured through the DICOM-Worklist page of the DICOM Configuration menu (available to the Service Engineer only).

The following parameters can be configured:

- Local AE.
- Remote AE.
- Remote Host Address.
- Communication time out.
- Remote Port Number.

5.6 DICOM Performance Procedure Step Configuration

A remote DICOM Modality Performed Procedure Step Service Class Providers can be configured through the DICOM-MPPS page of the DICOM Configuration menu (available to the Service Engineer only).

The following parameters can be configured:

- Local AE.
- Remote AE.
- Remote Host Address.
- Communication time out.
- Remote Port Number.

5.7 DICOM Storage Commitment Configuration

Remote DICOM Storage Commitment service class providers is provided through the DICOM-Storage Commitment page of the DICOM Configuration menu (available to the Service Engineer only).

The following parameters can be configured:

- Number of Remote Servers.
- Local SCU AE.
- Local SCP AE (for receiving N-EVENT-REPORT in a different association via port 104).
- Communication time out.
- Remote Station displayed name.
- Remote AE.

- Host Address.
- Remote Port Number.

Images may be **automatically** transferred to any of the configured remote stations either by clicking a relevant icon in the ADR's Acquisition application or upon registration of a new patient.

Selection of manual or automatic transfer of images to the remote station is user-selectable.

5.8 Study Types Configuration

User-configurable Study Types are supported through the ADR's preset examinations screen. These user-defined Study Types are available for selection in the Patient Registration screen. Study Types are mapped to the DICOM Protocol Name (0018,1030) and Performed Procedure Step ID (0040,0253).